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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,700	09/30/2004	Kevin S. Petrarca	FIS920040258US1	5699

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INTERNATIONAL BUSINESS MACHINES CORPORATION  
DEPT. 18G  
BLDG. 300-482  
2070 ROUTE 52  
HOPEWELL JUNCTION, NY 12533

EXAMINER
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NGUYEN, TRAM HOANG

ART UNIT	PAPER NUMBER
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2818

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/16/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/711,700	PETRARCA ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Tram H. Nguyen	2818	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 22 January 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,4-13 and 16-20 is/are pending in the application.
- 4a) Of the above claim(s) 6-12 and 16-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4,5,13,15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Arguments***

Applicant's arguments filed 01/22/2007 have been fully considered. The traversal is on the grounds that Andricacos fails to disclose, teach, or suggest an impure copper seed layer. Any reference to seed layer 5 in Andricacos is to a copper, Cu, seed layer. (See e.g. Andricacos, col. 4, lines 57-58, col. 9, line - 40 - col. 10, line 10). Further, Andricacos does not disclose the source of the seed, or more particularly that the source of the seed is equivalent to the source of the fill." But the argument is found unpersuasive because eventhough Adricacos has been silent about the copper seed layer (reference numeral 5) derived from an impure copper source with a content of impurities, it would be inherently to include the copper seed layer derived from an impurity copper source because it was known in the art that the 'pure' copper seed layer means as a relatively pure copper. Indeed, the present Application states the industry 'pure copper' contains 99.999% pure copper (par.[0007], line 2). Moreover, the Examiner has found other references provide evidence that pure copper contains a small amount of impurity copper or copper alloy. For instance, Ding et al. (US 2001/0034126) teach the pure copper contains 99 atomic % pure and 1% impurity (see par.[0029]). Additionally, paragraphs [0015] and [0016] of Aiba (US 2004/0200727) states that pure copper having purity of 99 wt % or higher.

And applicant's argument that "Andricacos does not disclose the source of the seed, or more particularly that the source of the seed is equivalent to the source of the fill," the fact that applicant has recognized another advantage which would flow naturally

Art Unit: 2818

from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1 and 13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding **claims 1 and 13**, the phrase “said impurity content”—is not cleared. Because there are 3 different impurities mentioned as such: impure copper seed layer, impure copper fill, and impure copper source. So which ‘impurity content’ is it that Applicant tries to claim here. For the remainder of this Action, Applicant will interpret the electrode plated copper fill as the impurity content.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

***Claims 1,4-5,13,15 rejected under 35 U.S.C. 103(a) as being unpatentable over Andricacos et al. (US 6,709,562; hereinafter Andricacos).***

Regarding **claim 1**, Andricacos discloses a copper interconnect (fig. 6) comprising: an impure copper seed layer (reference numeral 5) derived from an impure copper source with a content of impurities that is deposited on a barrier layer (reference numeral 4), said barrier layer (4) prevents substantial diffusion of copper through to an underlying insulating layer (reference numeral 1);

Eventhough Adricacos does not explicitly teach the copper seed layer (reference numeral 5) derived from an impure copper source with a content of impurities, it would be inherently to include the copper seed layer derived from an impurity copper source because it was known in the art that the 'pure' copper seed layer means as a relatively pure copper. Indeed, the present Application states the industry 'pure copper' contains 99.999% pure copper (par.[0007], line 2). Moreover, the Examiner has found other references provide evidence that pure copper contains a small amount of impurity copper or copper alloy. For instance, Ding et al. (US 2001/0034126) teach the pure copper contains 99 atomic % pure and 1% impurity (see par.[0029]). Additionally, paragraphs [0015] and [0016] of Aiba (US 2004/0200727) states that pure copper having purity of 99 wt % or higher.

Andricacos teaches an impure copper (reference numeral 6) derived from an impure copper source with a content of impurities that fills an opening in said underlying insulating layer (6) that is deposited on said impure copper seed layer (5);

Although Andricacos fails to teach the material composition of said seed layer is substantially the same as material composition of said impure copper fill, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the same material composition for both the impure copper seed layer and the impure copper fill, since it is going to lower the cost of making the product.

As for the recitation “because said copper source of said impure copper seed layer is equivalent to said copper source of the impure copper, however some impurities in the impure copper fill are absent from the impure copper seed layer as consequence of deposition of the impure copper seed layer”, refers to an operational limitation and any such limitation must distinguish from the prior art in terms of structure rather than function, *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997); See also *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 228-29 (CCPA 1971; *In re Danly*, 263, F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959).

Andricacos teach the impurity content comprises not more than 1.20% by weight and not less than or equal 0.001% by weight (see col.2, lines 60-67).

Regarding **claim 4**, Andricacos discloses all the limitations of the claimed invention for the same reasons are set-forth above except for explicitly teaching the impure copper in said impure copper seed layer is substantially equivalent to said impure copper. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the same material composition for both

the impure copper seed layer and the impure copper fill, since it is going to lower the cost of making the product.

Regarding **claim 5**, Andricacos discloses all the limitations of the claimed invention for the same reasons are set-forth above; besides Andricacos also discloses the copper in said impure copper source comprises chosen from the group of C, Cl, N, O and S (col. 8, lines 41-46).

Regarding **claim 13**, Andricacos discloses a copper interconnect (fig. 6) comprising: an insulating layer that has an opening (reference numeral 1); a barrier layer (reference numeral 4) that prevents substantial diffusion of copper through to said underlying insulating layer that is deposited on said underlying insulating layer and lines said opening; an impure copper seed derived from an impure copper seed with content of impurity that is deposited on said barrier layer and fills said opening (fig. 6); an impure copper (reference numeral 6) derived from an impure copper source with a content of impurities that fills an opening in said underlying insulating layer (6) that is deposited on said impure copper seed layer (5). Although, Andricacos does not explicitly teach the material composition of said impure copper layer is substantially the same as material composition of said impure copper fill, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use the same material composition for both the impure copper seed layer and the impure copper fill, since it is going to lower the cost of making the product.

As for the recitation "because said copper source of said impure copper seed layer is equivalent to said copper source of the impure copper, however some

Art Unit: 2818

impurities in the impure copper fill are absent from the impure copper seed layer as consequence of deposition of the impure copper seed layer”, refers to an operational limitation and any such limitation must distinguish from the prior art in terms of structure rather than function, *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997); See also *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 228-29 (CCPA 1971; *In re Danly*, 263, F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959).

Andricacos teach the impurity content comprises not more than 1.20% by weight and not less than or equal 0.001% by weight (see col.2, lines 60-67).

Regarding **claim 15**, Andricacos discloses all the limitations of the claimed invention for the same reasons are set-forth above; besides Andricacos also discloses the copper in said impure copper source comprises chosen from the group of C, Cl, N, O and S (col. 8, lines 41-46).

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

Art Unit: 2818

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tram Hoang Nguyen whose telephone number is (571)272-5526. The examiner can normally be reached on Monday-Friday, 8:30 AM – 5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mathew Smith can be reached on (571)272-1907. The fax numbers for all communication(s) is (703)872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571)272-1625.

**THN**  
Art Unit 2818  
04/02/2007

*Andy Hung*  
*Andy Hung*  
*Primary Examiner*